

hibited for the first time; and all the pupæ, with the exception of those of *Papilio demoleus*, were brought home by Mrs. Monteiro.

Of American Diurnal Lepidoptera, *Papilio ajax* and *Papilio turnus* were exhibited for the first time.

Amongst other insects that I obtained last year were a large number of the cocoons of, I believe, *Thyridopteryx ephemeriformis*. From these cocoons many male insects emerged and copulated with the females, which do not leave the cocoon, and the result was that some hundreds of young larvæ were produced. Of these only one survives, and I exhibit it this evening, in its curious covering. It has been reared upon young oak, raised from acorns. When the male insects first emerge from the cocoon, their wings are covered with a brownish hair, which makes them quite opaque, but on the slightest movement of the wings this at once disappears. A full description, together with figures, of this insect will be found in the First Annual Report of the U.S. States Entomologist, p. 147, by Mr. Charles V. Riley. As it is placed amongst the noxious insects by that gentleman, it is perhaps as well, in this case, that I did not succeed in rearing more than one of the larvæ.

In conclusion, I take this opportunity of thanking Mr. W. H. Edwards, of Coalburg, West Virginia, through whose kind assistance and interest I have been able to obtain many species of American insects.

The following papers were read:—

1. On the Anatomy of *Hydromys chrysogaster*. By BERTRAM C. A. WINDLE, M.A., M.D. (Dubl.), Professor of Anatomy in the Queen's College, Birmingham. (Communicated by Dr. MIVART.)

[Received December 20, 1886.]

The following notes are the result of an examination of a specimen of the above-named animal, obtained shortly after its death.

External Appearance.

Measurements (in centimetres).

Length from snout to tail	66·0
„ of tail	29·0
„ of head	7·0
Distance from snout to eye	3·3
„ „ eye to ear	2·1
Length of humerus	3·6
„ forearm	4·2
„ femur, from apex of great trochanter	5·0
„ leg	6·3
„ hand, to apex of claw of medius	3·5

Length of web of hand, deepest	·8
„ claw of hand, longest	·7
„ foot	7·8
„ web of foot (deepest at its narrowest part) ..	1·5
„ claw of foot, longest	1·0

The colour of the back is black with an admixture of golden-coloured hairs; the abdomen is covered with hairs of a dark golden colour, a narrow strip of flaxen hairs running longitudinally down the body from the lower part of the neck, ceasing at the lower third of the abdomen. The tail is black, save for its last fifth, which is flaxen-coloured. The hands (*vide* fig. 3) are armed with moderately strong claws, and the digital interspaces are webbed to a small extent. The feet (*vide* fig. 4) are armed with much stronger claws, and have considerably deeper webs in the interspaces. The soles of the feet are black, the palms of the hands of a lighter colour, and the dorsal surfaces of both are clothed with short golden hairs. The scrotum is large and covered with hair; it contains the testicles, which are easily to be returned to the abdomen.

Muscular System.

Panniculus.—The dorsal portion extends over the entire back as a thin sheet. It is especially strong and well-marked (1) over the head, especially the vertex, from which it passes into the cheeks and becomes connected with the roots of the large cheek-hairs; (2) in the scapular region and over the latissimus dorsi, with which it has some connections; and (3) over the back of the thighs, where it is associated in some degree with the hamstring muscles. The ventral part is attached to the inner aspect of the deltoid ridge under the deep portion of the pectoralis, and extends downwards from this attachment over the thorax and abdomen.

Muscles of the Head and Neck.—By the side of that portion of the panniculus which passes to the cheek there lies a slender muscle which, taking origin from the bone in front of the orbit, ends in a tendon which is inserted into the side of the cartilage of the nose (*levator alæ nasi*). There is a large elevator of the upper lip, separated from the panniculus by the numerous and large branches of the infraorbital nerve, and prolonged into the mucous membrane of the roof of the mouth as far as the middle line. In front of this is a *dilatator naris*. A small *buccinator* is present. *Levator labii inferioris* arises from the upper surface of the inferior maxilla just posterior to the incisors and descends, expanding considerably, to the skin below the jaw.

Masseter consists of three parts:—(1) arises by tendon from a prominent tubercle placed at the front of the lowest portion of the process of bone extending downwards from the zygoma to the superior maxilla and its alveolar portion. The muscular fibres connected with this expand and are attached to the edge and internal surface of the angle of the jaw. (2) arises from the lower margin of the zygoma, and is inserted into the lower jaw from its angle to about the position of the roots of the incisors. (3) arises partly from

the under and inner part of the zygoma within the orbit, and partly from the superior maxilla anterior to the orbit; this last portion joining the rest by passing between the superior maxilla and the zygomatic process just mentioned. This 3rd part joins the anterior part of the 2nd. The remaining facial muscles call for no special notice.

Sterno-mastoid, which is larger than cleido-mastoid, is inserted by a small round tendon into the mastoid process. Cleido-mastoid takes origin from the inner part of the clavicle, and is attached under the last to the mastoid process.

Sterno-hyoid: both muscles are united into a single sheet without trace of median differentiation. The middle part is inserted much higher up than the two lateral, viz. in the angle between the two anterior bellies of the digastrics, the lateral fibres being attached below the tendinous part of the digastric and near the omo-hyoid. The omo-hyoid itself has no central tendon. Digastric has no true tendon, the central position connected with the hyoid being constricted and covered on its superficial surface with a few tendinous fibres. The two anterior bellies are connected with one another.

It may perhaps here best be noted that the two halves of the inferior maxilla are extremely movable upon one another, a quantity of fibrous tissue intervening at the symphysis so as to form a kind of fulcrum by means of which a scissors-like action of the extremely long inferior incisors is obtainable (*vide* fig. 5). The teeth are divaricated from one another partly by the action of the digastrics and partly by a transverse intermandibular muscle (fig. 5, *a*), which lies above the insertion of the digastrics and quite separate from them. It is placed at the upper part of the angle between the two halves of the maxilla, and is attached to the inferior surface of either. Approximation is produced, at least in part, by the masseter and especially by the part described above as 1. From this it appears that an interval could be produced between the two lower incisors during the opening of the mouth which would disappear with its closure. Murie and Bartlett¹, in a paper on the "Movement of the Symphysis of the Lower Jaw in the Kangaroo," give an excellent account of the mechanism of this movement in the Macropodidæ, and quote from Good's 'Book of Nature' a statement to the effect that a similar movement takes place in *Mus maritimus*, the African rat. In *Hydromys* there is no such development of the transverse fibres of the orbicularis oris as the above authors describe in *Halmaturus bennettii*; whilst the intermandibular muscle above mentioned is quite distinct from any of the other inframaxillary muscles, all of which are present in addition. The amount of divergence possible would be from $\frac{1}{8}$ to $\frac{1}{4}$ inch.

Muscles of Shoulder-girdle and Upper Extremity.—The two portions of the trapezius are quite distinct, the origin of the lower being partly from the lumbar fascia. There is a large occipital rhomboid, and rhomboidei major and minor form a single sheet without separation. Omo-cervicalis arises from the transverse

¹ P. Z. S. 1866, p. 28.

process of the atlas, and is inserted into the spine of the scapula and acromion process as far as its apex. Pectoralis major consists of two layers folded in upon one another so as to present a rounded anterior border without any trace of division. The superficial portion arises from the clavicle and from the sternum as low down as the upper part of the xiphoid cartilage. This part is inserted (1) as usual, (2) into a common tendon with the deltoid. The deeper portion arises from the cartilages of the true ribs from the third to the last. This is inserted by two distinct slips, one of which passes to the tip of the acromion process, and the second to the fascia of the shoulder-joint and to the humerus external to the biceps, and as low down as to the upper edge of the attachment of the superficial portion. As has been above observed, there is no trace of the duplicity of these muscular sheets at the edge; in fact it is only by dissecting carefully through the outer that the inner is reached. This inner sheet is obviously the pectoralis minor, and the condition present is one of extreme fusion of the two pectoral muscles; or, perhaps better, of complete tucking-in of the p. major to form p. minor.

Subclavius is strong and well-marked, a fact which corresponds with the comparatively small and freely movable clavicle. Serratus magnus and levator anguli scapulæ form a single undivided sheet. Latissimus dorsi sends down a fairly broad but very thin latissim-condyloideus to the olecranon. Coraco-brachialis is inserted into the humerus (1) in the usual position; (2) from this point as far down as the upper part of the internal condyle. The long head of the triceps is very large and arises from rather more than one third of the axillary border of the scapula. Flexor profundus digitorum consists of two parts which unite under the annular ligament: the first arises from the internal condyle, the second from the radius, ulna, and interosseous ligament. There are three lumbricales, passing to minimus, annularis, and medius. Extensor communis digitorum sends a slip to each digit. Extensor indicis supplies that digit alone; and extensor minimi digiti sends tendons to minimus and annularis. Pollex has one extensor. There is no supinator longus.

Minimus has an abductor arising entirely from the pisiform, an opponens and a flexor brevis. The last arises from a small ossicle imbedded in the palmar fascia, slightly to the radial side of the centre of the palm and at its proximal portion. From this also arise the few fibres representing flexor brevis pollicis. This last diminutive digit has also on its outer side a few fibres representing abductor and opponens, and on its inner side an excessively rudimentary adductor. Minimus has an interosseous on its radial side; and each of the remaining digits has a pair lying in the same plane on its palmar surface.

Abdominal Muscles.—At the upper part of the abdomen, the three usual lateral muscles are present and distinct; at the lower portion, as the fibres of the internal oblique and transversalis run parallel and are closely connected with one another, there can hardly be said to be any true differentiation between them. From the aponeurosis of the external oblique a sheet of fascia passes down upon the large funicular process of peritoneum containing the testicle.

This represents the intercolumnar fascia of human anatomy. From the lower border of the combined internal oblique and transversalis a number of muscular fibres pass on to the same process and surround it as a series of rings nearly to its lower end. There is a large erector penis overlying the crus of either side, but no transversus perinei. The bulbus urethræ is double, and each half is overlaid by a muscular sheet which joins its fellow of the opposite side in a raphé on the lower surface of the penis; posteriorly the two halves unite behind the rectum, round which tube they form a kind of sling. In the angle between this last muscle (accelerator urinæ) and erector penis lies Cowper's gland. The psoas and iliacus muscles are both large and differ in no respect from the normal. There is no psoas parvus. Rectus abdominis is attached to the second rib.

Muscles of the Lower Extremity.—The exterior of the buttock is covered by a large sheet of muscle arising from (1) crest of ilium, (2) under the anterior superior spine of the ilium, (3) by means of an aponeurosis from all the vertebræ from the last lumbar to the last sacral inclusive. It is inserted into (1) the third trochanter at the middle of the femur; (2) the larger part into the fascia on the outer side of the thigh and leg and the upper part of the patella. As there is no separate tensor vaginæ femoris or sartorius, this muscular sheet would appear to represent these two in fusion with gluteus maximus. Gluteus medius is very large; its anterior fibres are inserted into the outer edge of the great trochanter, its posterior into the femur inferior and anterior to this process. Gluteus minimus arises from the concavity of the ilium, and is inserted by tendon into the upper part of the great trochanter. There is no separate or intrapelvic pyriformis; part of the fibres of the gluteus minimus arising from the edge of the sacrum close to the sacro-sciatic foramen appear to represent this muscle.

Biceps is very large, and arises (1) superficially from the upper caudal vertebræ by fascia; (2) deeper, from the tuberosity of the ischium. The two parts unite, and are inserted (1) by fascia into the outer part of the patella; (2) by tendon into the process near the head of the fibula; (3) by fascia into the whole of the front of the leg as far down as the back of the heel. Thus the entire of the thigh and leg below gluteus maximus is covered by this large muscular sheet.

Semitendinosus is single-headed and arises from the tuberosity and adjacent portion of the ischium; it is inserted into the crest of the tibia below the gracilis. Semimembranosus, which is very much smaller than either of the other hamstring muscles, is inserted into the upper part of the posterior aspect of the internal condyle of the femur.

Rectus femoris has a single tendon with a double attachment, viz. under the acetabulum and to the margin of the ilium. There is a scansorius arising from the entire of the anterior edge of the ileum.

Pectineus consists of two distinct parts—(1) Internal, which is thin and arises from the inner part of the linea ileo-pectinea, some of its fibres underlying the outermost of gracilis; this portion is inserted

by a flat tendon into the back of the femur at the junction of its lower and middle thirds. (2) External, which is much thicker and rounded, arises from a prominent tubercle near the centre of the linea ileo-pectinea, and is inserted into the femur from the lower part of the lesser trochanter to the upper border of the internal part of the same muscle.

Gracilis is very large, and arises from the inner part of the linea ileo-pectinea, from the pubic crest, symphysis pubis and ramus of that bone, covering in the other adductors; it is inserted into the crest of the tibia, occupying nearly its upper half. Adductors longus, magnus, brevis, and quadratus are present; the lower fibres of magnus pass down as low as the head of the tibia.

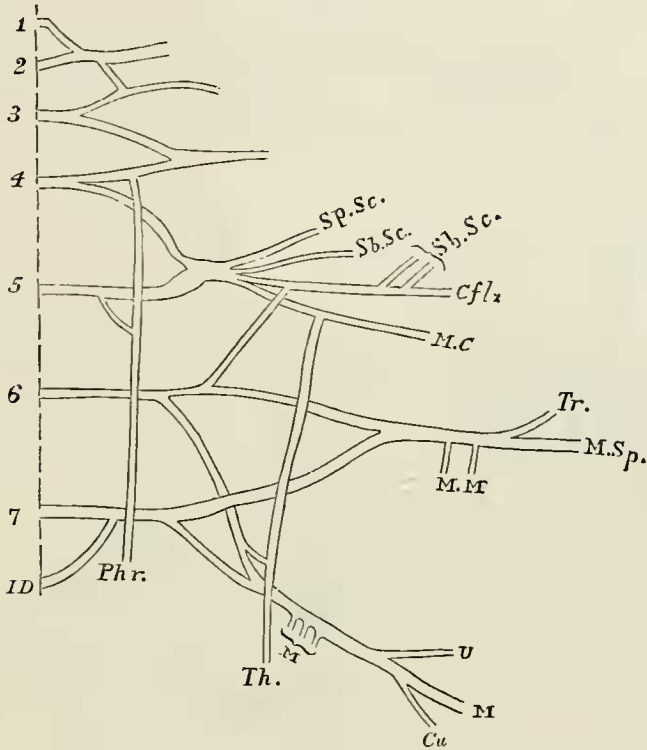
Gastrocnemius is large and its heads are without sesamoids. It is joined by soleus, which is small, and fibular only in its origin. There is no separate plantaris, but the posterior part of the tendo Achillis passes over the back of the os calcis, to which by far the greater part of the same tendon is attached, to the sole of the foot. With this tendon are connected on its superficial surface a number of muscular fibres, from which and from a slight continuation on the deep surface of the fibres of the plantar portion of the tendo Achillis arise the four perforated tendons of the toes. There is no flexor longus hallucis as a separate structure. A large muscle occupies the whole of the internal and posterior portion of the leg; this ends in a single large tendon, which divides into five slips for the toes. Tibialis posticus is a small muscle with a long tendon; its belly lies under the upper part of flexor longus digitorum. There are peronei longus, brevis, quinti, and quarti. Tibialis anticus and extensor longus digitorum, which last has four terminal tendons for the four outer toes, are much fused. There is a small but distinct extensor proprius hallucis. Extensor brevis digitorum sends tendons to the four outer toes. There is a large popliteus. Hallux has an adductor which arises from the middle of the inferior surface of the os calcis, and ends in a long tendon which is inserted into the inner side of the head of the metatarsal; an opponens and a strong flexor brevis. Minimus has a strong abductor and an interosseal flexor brevis. Each of the remaining digits has a single muscular mass lying on the plantar aspect of its metatarsal without other trace of division than an incomplete median longitudinal fibrous intersection. This muscle is in each case inserted into the base of the first phalanx and into the superior surface of the fibro-cartilage lying over the metatarso-phalangeal articulation.

Nerve Plexuses.

Brachial Plexus (fig. 1).—The fourth cervical nerve divides into two portions, from the upper and smaller of which is derived the greater part of the phrenic. The lower portion joins the 5th, which has previously given a filament to the phrenic. The combined cord formed from 4 and 5 breaks up into four branches—supra- and sub-scapular (smallest), circumflex and musculo-cutaneous. Circumflex gives off a branch of communication to the upper part of the 6th nerve and also two subscapular branches. Musculo-cutaneous gives

off the greater portion of the anterior thoracic nerve. The 6th nerve divides into two portions, an upper and lower. The combined cord formed by the 7th cervical and 1st dorsal also divides into two

Fig. 1.



Cervical and brachial nerves. (Diagrammatic.)

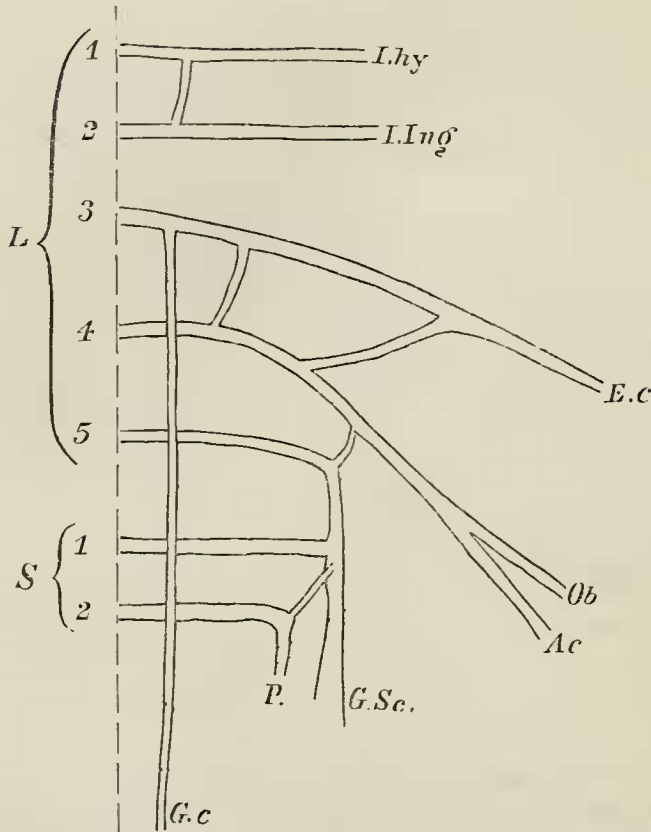
1-7. Cervical nerves; *I.D.* 1st dorsal nerve; *Sp.Sc.* Suprascapular; *Sb.Sc.* Subscapular; *Cflx.* Circumflex; *M.C.* Musculo-cutaneous; *Tr.* Nerve to triceps; *M.Sp.* Musculo-spiral; *U.* Ulnar; *M.* Median; *Cu.* Internal cutaneous; *Phr.* Phrenic; *Th.* Anterior thoracic; *M.M.* Muscular branches.

portions, an anterior and a posterior. The upper part of the sixth, having received the branch from the circumflex, joins the anterior part of 7+1, and the combined trunk becomes musculo-spiral, having previously given off branches to the triceps and other muscles. The lower division of 6 joins the posterior of 7+1, having first given off a filament which joins the anterior thoracic. The large trunk thus formed, having given off some muscular branches, splits up into ulnar, median, and internal cutaneous.

Lumbo-sacral Nerves (fig. 2).—The 1st lumbar forms the ilio-hypogastric and the 2nd the ilio-inguinal. These nerves are connected with one another by a communicating branch, but have no junction with those below. The 3rd gives off genito-crural, a branch of communication with 4, and in conjunction with a branch from this last forms external cutaneous. The remaining portion of 4 with a branch from 5 forms a common trunk which divides into obturator and anterior crural. The great sciatic is formed by the

greater part of the 5th lumbar, the whole of the 1st sacral, and a twig from the 2nd. The pudic nerve is formed from the remaining portion of the 2nd.

Fig. 2.



Lumbar and sacral nerves. (Diagrammatic.)

L.hy. Ilio-hypogastric; *L.Ing.* Ilio-inguinal; *E.C.* External cutaneous; *Ac.* Anterior crural; *Ob.* Obturator; *Gc.* Genito-crural; *G.Sc.* Great scatic; *P.* Pudic.

Thorax.

The chief points of interest are as follows:—(1) *Triangularis sterni* is very large and well-marked. It ascends nearly as high as the upper margin of the sternum. (2) The diaphragm is in most respects in no way different from the ordinary condition. Its central tendon is, however, triradiate, consisting of three strips of fibrous tissue arranged somewhat like an arrow-head; one of these is directed towards the sternum, a second backwards and to the right, a third backwards and to the left, and the interval between these last is muscular.

(3) *Lungs.*—The left has three lobes, divided in a way similar to that of the right lung in the human subject. The right has five

lobes, the supernumerary pair being placed behind and below the others.

Alimentary Canal and Appendages.

Teeth.—The dentition is as described by Owen¹, I. $\frac{1}{2}$, M. $\frac{2}{2}$, the total number thus being smaller than that of any other Rodent. The incisors closely resemble those of the Common Rat.

The upper incisors are stouter and shorter than the lower; they are set closely together, their edges meeting at their inner angles, so as

Fig. 4.



Fig. 3.



Fig 5.

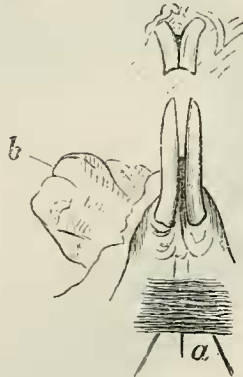


Fig. 3. Left hand of *Hydromys chrysogaster*. (Natural size.)

Fig. 4. Left foot of *Hydromys chrysogaster*. (Natural size.)

Fig. 5. Upper and lower incisors of *Hydromys chrysogaster*: *a*, intermandibular muscle; *b*, tongue.

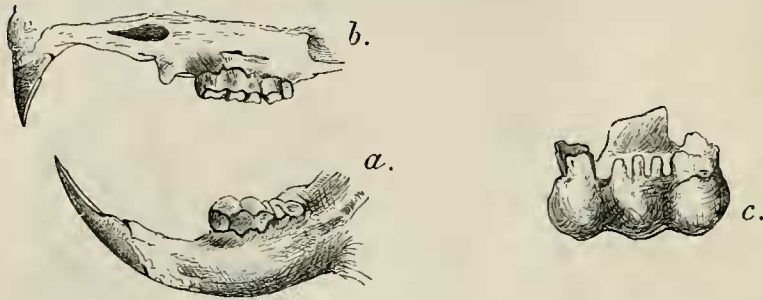
to enclose a wide angle (*vide* fig. 5). The portion projecting beyond the alveolus is 1.05 cm. in length. The first upper molar is a large tooth, consisting of two segments of nearly equal size and a third of lesser magnitude (*vide* fig. 6, *b* and *c*). It possesses three large fangs, one at either extremity and the third at the middle and on the lingual edge. At the opposite side of the tooth to this last are three

¹ 'Odontography,' vol. i. p. 410, and Comp. Anat. of Vert. vol. iii. p. 300.

excessively small points, each of which fits into a corresponding depression in the alveolus (*vide* fig. 6, *c*).

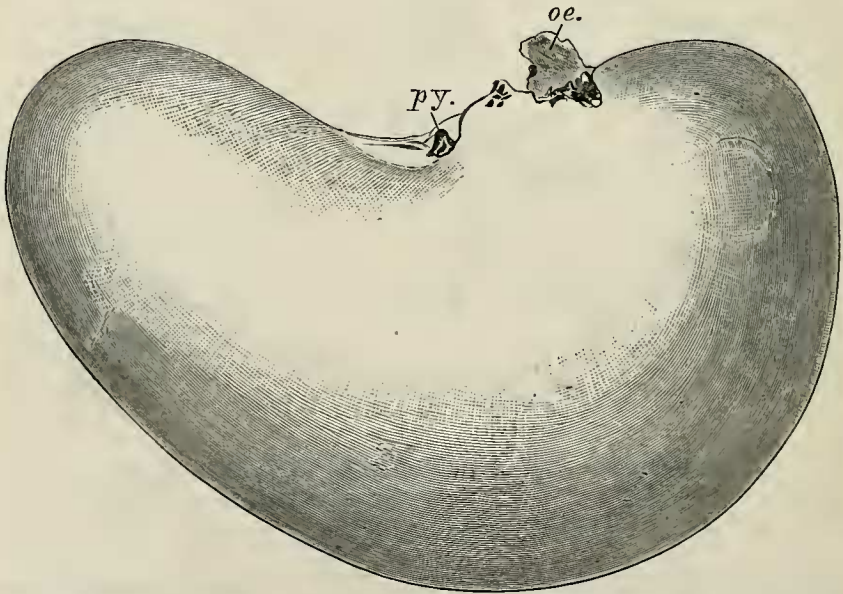
The second upper molar looks like one of the divisions of the first with an additional cusp attached to its antero-internal corner. It has three roots, two posterior with their surfaces placed external and internal, and one anterior with its surfaces anterior and posterior. The

Fig. 6.



Hydromys chrysogaster: *a*, lower jaw; *b*, upper jaw; *c*, upper molar (enlarged).

Fig. 7.



Stomach of *Hydromys chrysogaster*: *oe.*, cardiac orifice; *py.*, pyloric orifice.

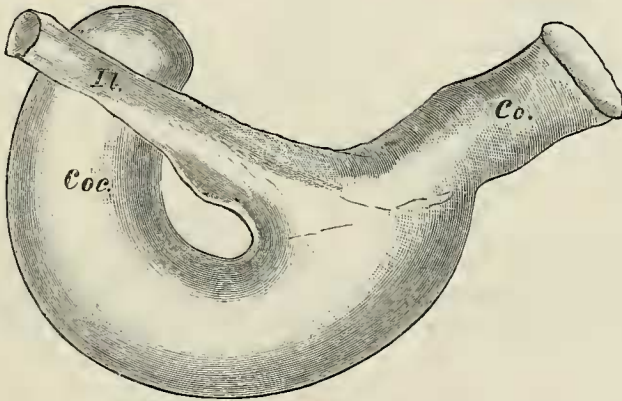
lower incisors (*vide* figs. 5, 6, *a*) are of greater length (1.55 cm.) and of about the same breadth, but of less thickness (0.25 cm. as compared with 0.4 cm.) than the upper. Their power of approximation, due to the mobility of the two halves of the inferior maxilla, has already been

dwelt upon. The lower first molars consist of two nearly similar segments placed one in front of the other; and the second are much the same in appearance but smaller (*vide* fig. 6, *a*).

Tongue.—4·6 cm. in length; it has an average breadth of 1·0 cm. It possesses a single large circumvallate papilla, situated at the centre near the posterior part. There is a small group of folia on either side in front of the anterior pillar of the palate.

Intestinal Canal.—The stomach is simple in structure, and the chief points to be remarked upon are the increase in size of the pyloric portion and the decrease in length of the part corresponding to that named in the human subject the lesser curvature (*vide* fig. 7). The small intestines measure 2 m. 89·5 cm.; the large 27·8 cm.; and the cæcum about 7·0 cm. This latter portion is quite simple and only slightly curved upon itself (*vide* fig. 8).

Fig. 8.



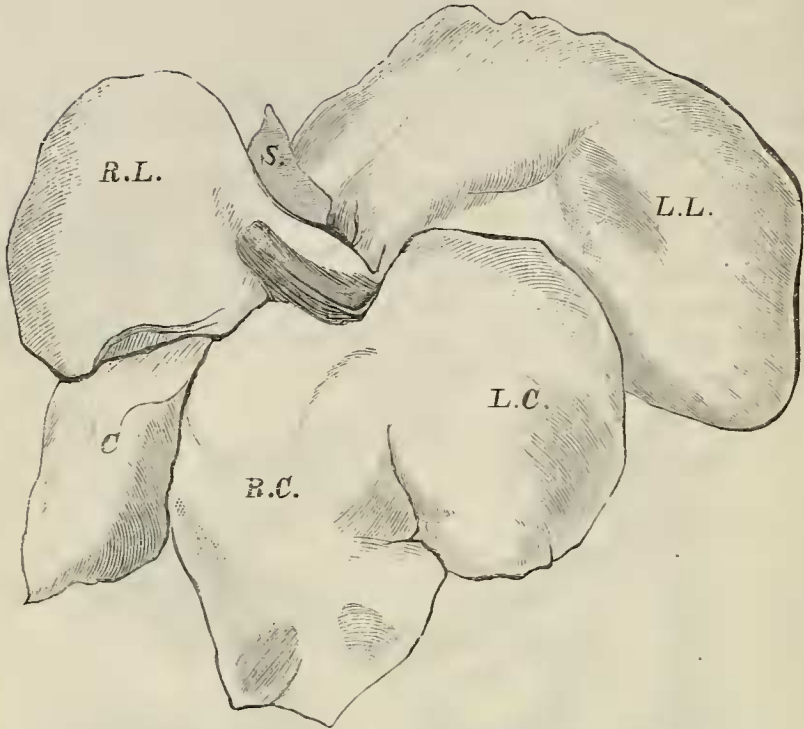
Cæcum of *Hydromys chrysogaster*. (Natural size.)

Co. Colon; Il. Ileum; Coc. Cæcum.

Liver.—This organ possesses six lobes. The right lateral is short and permits the caudate, which is comparatively long, to be seen upon the upper surface. It appears between the right central and lateral lobes. There is no gall-bladder (*vide* figs. 9 and 10).

Genitalia.—The vesiculæ seminales are very long and narrow, extending a considerable distance above the bladder. Their length is 5·6 cm., average breadth about 1·0 cm. The testes are large and were, when the animal was examined first, placed in the scrotum. The length of each is 4·2 cm., circumference 6·2. In life these measurements would probably be larger, as they were made after the animal had been in spirit and water for a day or two. The globus major and minor are very distinct and united by a single tube which is perfectly straight. The length of major is 4·8 cm., minor 2·1. There is a small os penis (1·1 cm. in length), consisting of a somewhat square-shaped base with a tapering anterior portion. From each side of the base a small process descends, each of which lies on

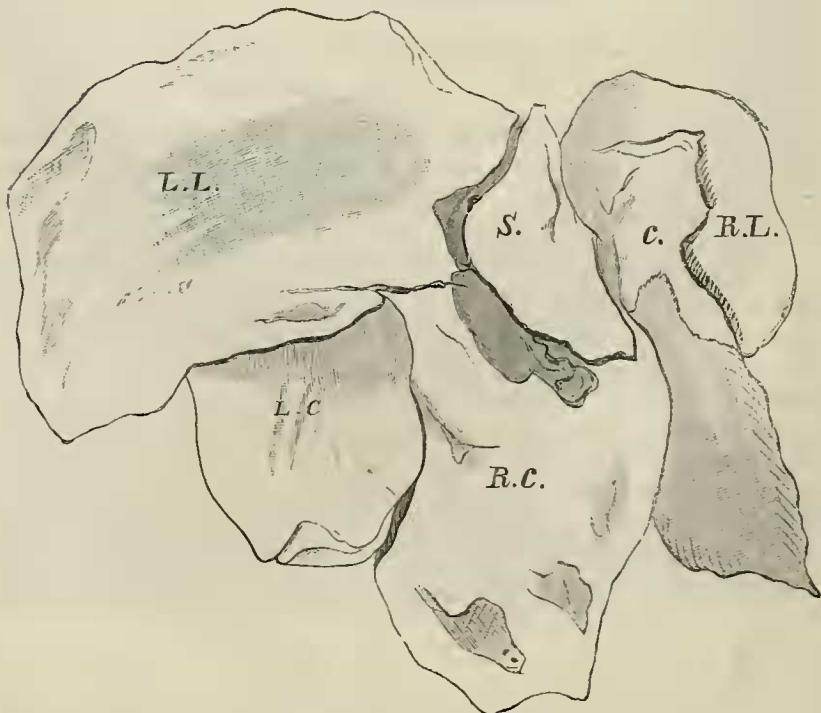
Fig. 9.



Superior surface of liver of *Hydromys chrysogaster*.

L.L. & *L.C.* Left lateral and central lobes; *R.L.* & *R.C.* Right lateral and central lobes; *C.* Lobulus caudatus; *S.* Lobulus Spigelii.

Fig. 10.



Under surface of liver.

L.L. & *L.C.* Left lateral and central lobes; *R.L.* & *R.C.* Right lateral and central lobes; *C.* Lobulus caudatus; *S.* Lobulus Spigelii.

